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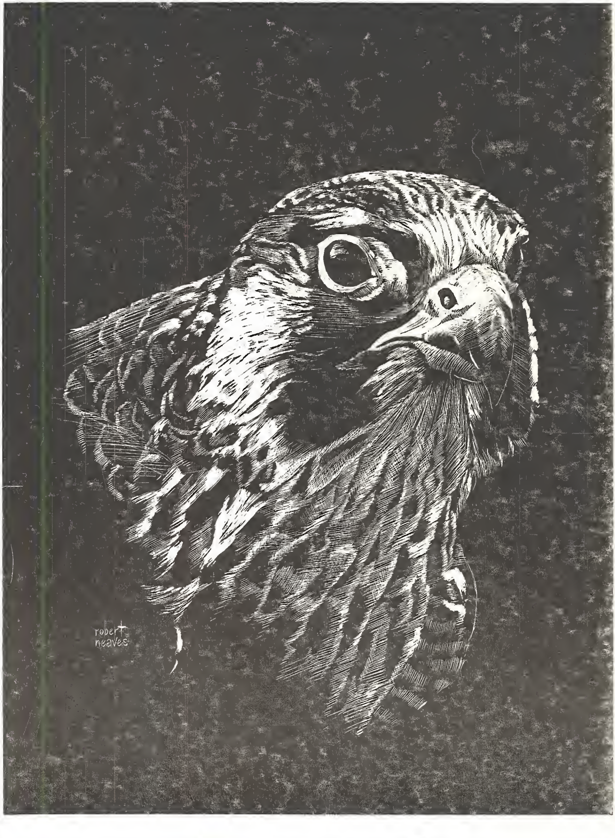

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Peregrine Falcon
and Its Habitat

Margaret Herman
and
E. Earl Willard

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INTRODUCTION

This publication has been developed as an attempt to summarize the existing information on the peregrine falcon (Falco peregrinus) in North America, with emphasis on the western United States. It is particularly directed toward examining the historical distribution, present status, and habitat relationships of the species. As our literature review and correspondence with persons knowledgeable about the peregrine progressed, it became apparent that the status of the peregrine is perilous, and all possible efforts must be taken to understand its ecology and to protect its habitat. As will be discussed later in the section on Habitat Relationships, the nest sites of the peregrine are rather specific, and must be identified and protected from human disturbances.

HISTORICAL PERSPECTIVE

There are twenty-two subspecies of the peregrine falcon in the world. Of these, three subspecies (Falco peregrinus anatum, Falco peregrinus tundrius, and Falco peregrinus pealei) occur in North America. The only subspecies to be protected by the Endangered Species Act of 1973 is Falco peregrinus anatum. A distribution map of the breeding ranges of this subspecies in North America is shown in Figure 1. In Figures 2 and 3 are illustrated the known nesting areas of the peregrine in the Northwest and the probable number of nesting pairs for the western states from New Mexico north to Montana and Alberta as of 1965.

The first public concern for the welfare of the peregrine was expressed in Britain after World War II when drastic declines in the number of successful nests were documented. It was later ascertained that the eggshells were markedly thinner than eggs collected prior to WW II. The weight of the female on the eggs during incubation was causing many of the thinner eggs to crack, thereby killing the embryos. Similar problems soon spread to the eastern United States. The peregrine prior to WW II was considered quite common throughout the eastern United States, but in the 1950's and 1960's sharp declines were noted in the nesting populations. To date, few pairs if any have nested in the East except for some artificially-introduced birds which were pen-raised under a program sponsored by Cornell University.

Peregrines have historically been relatively sparse in the Intermountain West, with perhaps 1 nest/20,000 square miles rather than the normal 1 nest/2,000 square miles in other areas (Bond 1946). Elevation, the lack of water and food, and competition with the prairie falcon have been cited by

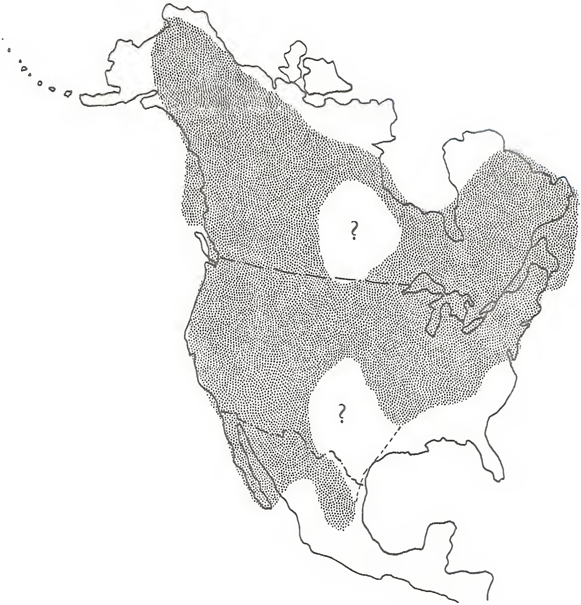


Figure 1. Generalized breeding range of *Falco peregrinus anatum* in North America (redrawn from Zimmerman 1972).

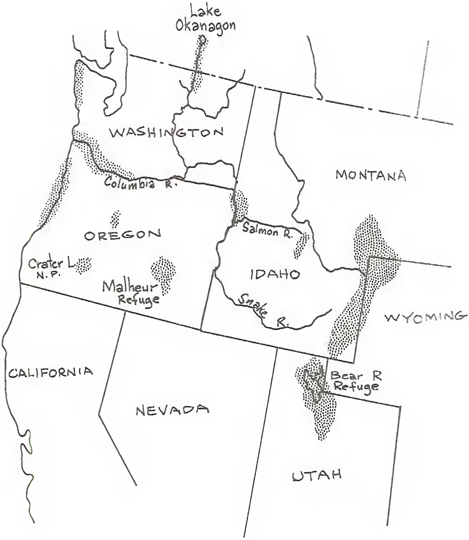
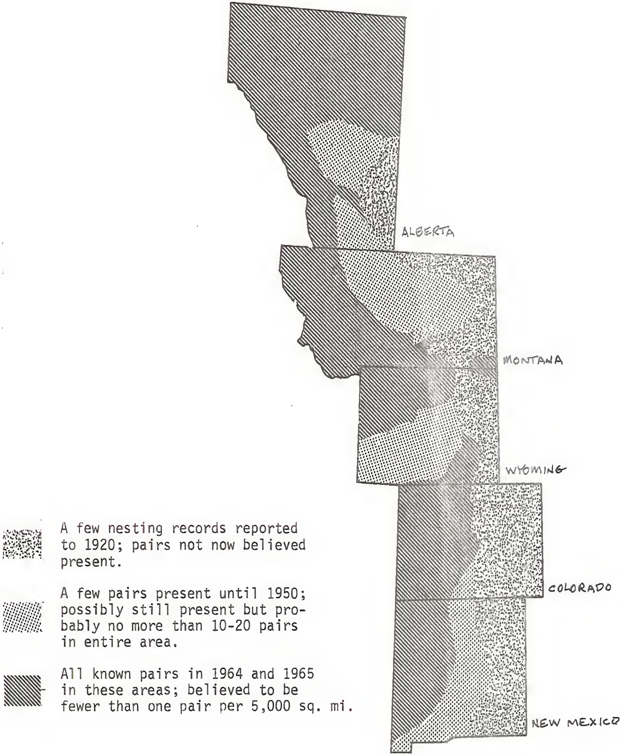


Figure 2. Regions of the Northwest where nesting peregrines were found in some numbers (redrawn from Hickey, ed. 1969).



ALBERTA
MONTANA
WYOMING
COLORADO
NEW MEXICO
A few nesting records reported to 1920; pairs not now believed present.
A few pairs present until 1950; possibly still present but probably no more than 10-20 pairs in entire area.
All known pairs in 1964 and 1965 in these areas; believed to be fewer than one pair per 5,000 sq. mi.

Figure 3. Historic distribution of breeding peregrines along the Rocky Mountain corridor (redrawn from Hickey, ed. 1969).

Bond (1946) as possible reasons for a low density of peregrines in the Palouse Prairie region of Washington, Oregon and Idaho.

Because of the decline of the peregrine in the East, more studies were initiated to document its status in the West and to attempt to alleviate a similar decline. Observations were made on historically-used nests and the number of adults, fledglings and juveniles were recorded. Presented in a later section of this paper are statistics from several authorities showing declines in the use of traditional nests, successful nests, and adult pairs available for nesting in the West during the 1960's and 1970's and more recently in Alaska. Alaska has had a large nesting population of peregrines, and continues to have the largest population within the United States. It has always been the most secluded nesting area, thus minimizing human disturbances of nests. Reasons for the decline of the peregrine in the West will be covered in a later section.

PRESENT DISTRIBUTION AND STATUS

Extensive studies of the breeding success of the peregrine in the Rocky Mountains have been conducted by James Enderson and Jerry Craig. During a recent survey they found that only eleven of the thirty-two known nesting sites were still occupied by pairs in 1973. It was estimated that over the past 20-30 years there has been at least a 50% decline in the peregrine population, along with a decline in the use of nest sites with only one-third of the former eyries still being occupied (Enderson and Craig, 1974a).

Hickey (editor 1969) estimated an 80-90% decline in the peregrine population in Utah, Idaho, Oregon, Washington, western Wyoming and western Montana. Herman (1971a) stated that in the past 25 years a 95% decline occurred in the California population.

The following statistics presented by Bitely (1974) show the estimated distribution and known pairs of peregrines in North America exclusive of Alaska and the Arctic:

Alberta	7
British Columbia	10-15
Northern Rockies	1
Southern Rockies	14
Texas	8
Idaho	4
Colorado	5
Washington	12

Oregon	3
California	10
All of North America	less than 100

RECENT SIGHTINGS

Table 1 lists recent sightings of peregrines and nests, along with comments for Montana, Utah, Idaho, Washington and Colorado.

Table 1. Recent observations of peregrines in Montana, Utah, Idaho, Washington and Colorado.

State	Location	Date	Comments	Source
Montana	Ravalli Natl. Waterfowl Refuge	1972 1973-74	2 migrating peregrines observed 1 migrating peregrine	Bob Twist (pers. com. 1975)
	Flathead National Forest (Spotted Bear Ranger District)	-	Flying peregrine observed Eyrie located on South Fork of Flathead River	John W. Baglien (pers. com. 1975)
	Beaverhead National Forest	1972	Single peregrines observed at two different locations	Poff (pers. com. 1975)
	Red Rock Lakes Natl. Wildl. Refuge	-	Occasional sightings; no indication of nesting	Jim Roscoe (pers. com. 1975)
	Kootenai National Forest	1975	One recent report of nesting peregrines	William Ruediger (pers. com. 1975)
Utah	Bureau of Land Management (Richfield District)	1970 1971	Peregrine observed, Iron Co. Peregrine observed, Sevier Valley	Elbert J. Lowry (pers. com. 1975)
	B.L.M. Lands of Utah			
	Garrison, Utah	1973	Peregrine observed	D. Duff (pers. com. 1975)
	Desert Range Expt. Sta.	1973		
	South end of Canyonlands Natl. Pk.	1974-75	Peregrines observed	
	South of Moab	1974-75	Peregrine observed	
	East of Price	1975	Peregrine observed	
	Green River	1975	Peregrine observed	
	Escaliente Desert	-	Winter residents	Joe Jarvis (pers. com. 1975)
Idaho	Clearwater Natl. Forest	1975	Occasional unconfirmed sightings	Donald R. Jenni (pers. com. 1975)
	Snake River	-	Occasional sightings	Mohler (1973)
	Salmon River Breaks	-	Possible nesting habitat	John Ormiston (pers. com. 1975)
Washington	North Cascades Natl. Park	-	Occasional sightings	John R. Patterson (pers. com. 1975)
Colorado	Rocky Mountain Natl. Park	-	Peregrines sighted several times each year; no active eyries	David R. Stevens (pers. com. 1975)

REINTRODUCTIONS

Several projects are currently underway to reintroduce the peregrine into areas where it was once known to nest. Cornell University's program under the direction of Tom Cade has begun to release pen-raised birds into former nesting habitats. Potential release sites include the Appalachian Mountains, Yellowstone National Park and Teton National Park (Bitely 1974). Extensive research programs on the peregrine in the West have been conducted in Colorado by James Enderson and by Gerry Craig and in California by Steven Herman. Several methods of improving the status of the peregrine which are being considered for future use include double clutching, fostering of young, nest site improvement, and artificial improvement of the food supply (Cade 1974a).

HABITAT RELATIONSHIPS

A thorough search of the literature on peregrine habitat has revealed two limiting or critical aspects. Probably the most important of these two is the availability of a very specific type of nesting site. The other limiting factor is the availability of a ready supply of prey species. These, along with an environment free of pesticides, were the major, and generally only habitat relationships encountered in our literature search.

Food Habits

Peregrines feed almost exclusively on birds (Hickey, editor 1969). Enderson and Craig (1974b) reported that the prey remains found in three eyries included the following: 3 rock doves (*Columba livia*), 1 mourning dove (*Zenaidura macroura*), 6 white-throated swifts (*Aeronautes saxatalis*), 2 Steller's jays (*Cyanocitta stelleri*), 2 black-billed magpies (*Pica pica*), 1 Brewer's blackbird (*Euphagus cyanocephalus*), and 1 robin (*Turdus migratorius*). In Utah, peregrines also prey mostly on small birds and a variety of shorebirds, but occasionally feed on rodents and insects (Behle and Perry 1975). Linder et al. (1970) reported that birds make up 97% of the diet, while rodents made up 3%.

Porter and White (1973) stated that food availability appears to be a major criterion influencing the distribution and abundance of the peregrine in arid regions of the West. They fly very fast to catch their prey, and when diving may reach speeds of 200 miles per hour (Snow 1972), but do not

maneuver well in trees. Thus, they are restricted to more open areas. Due to their physical make-up (wing expanse, weight, etc.) they maneuver best at sea level and low elevations while their nearest competitor, the prairie falcon, maneuvers best at altitudes greater than 7,000 feet (Bond 1946).

In order to remain healthy, the peregrine's food intake must equal 11-12% of its body weight daily in warm weather and 15-16% in cold weather (Brown and Amadon 1968).

The capture of prey is apparently not easy. Cade (1960) found that many juveniles died because of poor hunting techniques. Brown and Amadon (1968) stated that often 10-12 false swoops are required before a successful kill is made.

When the young leave the nest, they do not remain with the adults. They often disperse into less favorable hunting areas where prey species are scarce; thus, juvenile mortality may be increased in less-favorable habitats.

Nest Sites

A suitable cliff seems to be the most critical feature of nesting habitat (Cade 1960, Hickey ed. 1969). Snow (1972) reported that the peregrine favors limestone cliffs because of the small depressions in them that provide a site for nest placement.

Blood (1973) stated that "the peregrine nests mostly on precipitous cliffs. In remote, relatively undisturbed areas such as the Canadian Arctic, however, steep slopes, river cutbanks, and even low rocks and mounds may be used. In North America, nests occur only rarely on flat ground or in trees ...". In a study by Enderson and Craig (1974a) peregrines

were found nesting on ledges of cliffs from New Mexico to Montana. Most of these cliffs were at least 45 meters high.

The preferred cliff is one that is extremely high, often rather long, usually overlooking water, and generally dominating the surrounding area (Bond 1946). Cade (1960) reported that there is no known instance of cliff-nesting away from water in Alaska. Nests of peregrines in Utah are associated with water, usually occurring within ½-1 mile from water (Behle and Perry 1975). Porter and White (1973) also reported that a suitable cliff near a marsh, lake, or stream is an important factor in Utah.

On Vancouver Island the birds nearly always choose the very top of a cliff under the roots of a spruce tree growing on the edge (Green 1946). The brink of the cliff is usually overgrown with dense thickets of alder (Alnus app.), willow (Salix spp.), wild rose (Rosa spp.), or other shrubs in Alaska (Cade 1960).

The major limiting factor at the nest seems to be the availability of a ledge, often with an overhang, having loose soil, sand, dead vegetation or gravel in which the peregrine can construct a "scrape" or shallow hollow in which to lay the eggs (Enderson and Craig 1974a, Cade 1960). The overhang seems to be a preference rather than a requirement. The nest sites and cliffs are commonly used for several years.

Whether or not a cliff with a particular exposure is required is not well established. Blood (1973) stated that a nest site with a southerly exposure is favored in the Arctic. However, Porter and White (1973) stated that most eyries in Utah are on east- and north-facing cliffs which furnish protection against the hot afternoon sun. It is possible that the exposure requirement varies with the climate of the region.

Enderson (1965) stated that the peregrine is not found in arid regions. They also do not nest in dense forests (Hickey, ed. 1969). They may be found in forests, but more often are present in moorland, grassland, steppes and scrubland from sea level to 10,000 feet (Brown and Amadon 1968). In Alaska, breeding peregrines show no affinity for a particular biome or major ecologic community (Cade 1960).

Habitat Model

The above review of the habitat relationships of the peregrine falcon provide an insight into its habitat requirements. Certainly, the peregrine must have a ready source of prey (mostly birds); a certain type of cliff for nesting; a nest site close to water; and protection from herbicides and human disturbances. The literature on peregrine habitat provides a rather specific description of food and nest site requirements, but surely there are other habitat requirements which have not been documented, such as its habitat requirements during the spring and fall migrations.

A conceptual model of peregrine habitat is presented in Figure 4. This model incorporates the habitat information encountered in the literature, and is a much-simplified model of a habitat that is probably more complex than the model indicates. This model should be tested and expanded or modified as additional information is obtained.

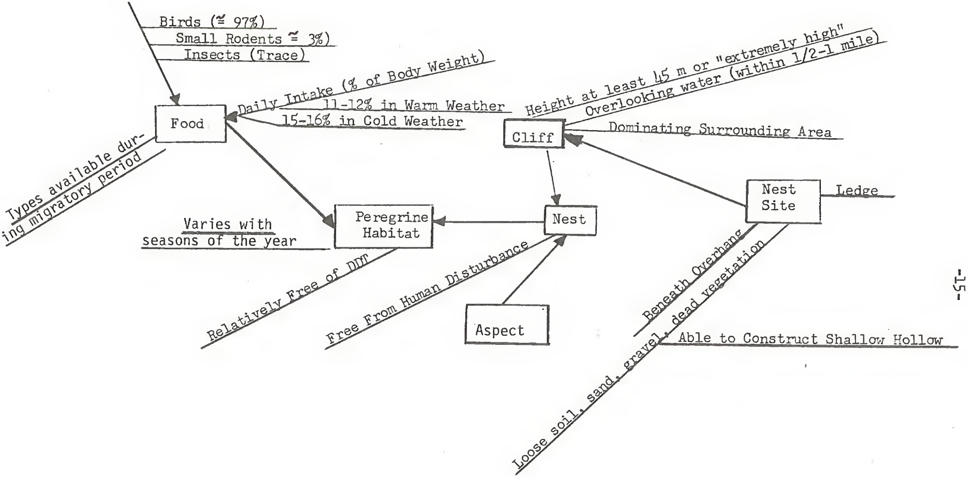

Birds (≅ 97%)
Small Rodents ≅ 3%)
Insects (Trace)
Daily Intake (% of Body Weight)
11-12% in Warm Weather
15-16% in Cold Weather
Food
Types available during migratory period
Varies with seasons of the year
Peregrine Habitat
Relatively Free of DDT
Height at least 45 m or "extremely high"
Overlooking water (within 1/2-1 mile)
Dominating Surrounding Area
Cliff
Nest
Free From Human Disturbance
Aspect
Nest Site
Ledge
Beneath Overhang
Loose soil, sand, gravel, dead vegetation
Able to Construct Shallow Hollow

Figure 4. Conceptual Model of Peregrine Falcon Habitat

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SOURCES OF INFORMATION BY SUBJECT

PRESENT STATUS	1,3,5,17,19,20,23,26,28,29,30,33,35,43,52,55,56,57, 62,63,66,67,73,74,76,77,80,81,83,86,87,88,89,90,94,97, 101
GENERAL INFORMATION	2,3,4,6,7,8,9,10,11,15,22,24,28,29,32,35,38,40,44,46, 47,48,49,50,51,54,55,61,64,65,68,69,70,71,72,77,78,84, 86,89,91,93,95,96,97,98,99,102,103
HISTORY	8,10,11,15,18,24,28,29,30,31,35,36,37,39,40,41,44,45, 46,48,49,50,51,52,53,54,55,70,71,77,78,82,83,84,85,91, 92,93,95,97,99,100,101,102,103
HABITAT	2,3,6,8,9,10,14,18,20,24,34,40,44,49,50,55,58,62,68, 74,77,78,84,93,97,98,99
REINTRODUCTION MEASURES	5,11,12,13,14,19,20,21,25,26,37,38,39,42,60,63,65,75, 84,97
PESTICIDE PROBLEM	5,11,15,16,27,31,39,45,48,50,51,54,59,61,63,77,79,84, 85,92,97,102,103